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March 29, 2001

U.S. Nuclear Regulatory Commission
Attn: Document Control Desk
Washington, D.C. 20555-0001

SUBJECT: Oconee Nuclear Station - Unit 3
Docket No. 50-287
Request to use an Alternative to ASME Boiler and Pressure Vessel Code, Section XI in accordance with 10 CFR 50.55a(a)(3)(ii)

Pursuant to 10 CFR 50.55a(a)(3)(ii), Duke Energy Corporation (Duke) requests the use of an alternative to the requirements of the ASME Boiler and Pressure Vessel Code, Section XI, Subsections IWA-4500(e)(2) and IWA-4533, 1992 Edition with no addenda for Oconee Unit 3.

Approval of this request would allow the use of an alternative to the examination requirements of IWA-4500(e)(2) and IWA-4533 following repair of Class A Reactor Vessel head components. It has been evaluated and determined that compliance with the requirements of IWA-4500(e)(2) and IWA-4533 would result in hardship and unusual difficulty without a compensating increase in the level of quality and safety. Entry into Mode 2 operation following completion of repairs is currently scheduled for April 16, 2001.

A detailed description of this proposed alternative, including a background discussion and justification, is included as an attachment to this letter.

Questions regarding this request may be directed to Robert Douglas at (864) 885-3073.

Very truly yours,

William R. McCollum

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Attachment:
Request for Alternative, Serial Number 01-03

cc w/att:

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DUKE ENERGY CORPORATION
Oconee Nuclear Station, Unit 3

Request for Alternative to the Requirements of the
ASME Boiler and Pressure Vessel Code, Section XI

Applicable Code Edition and Addenda

Pursuant to 10 CFR 50.55a(g)(4), ASME Code Class 1, 2, and 3 components (including supports) will meet the requirements, except the design and access provisions and the pre-service examination requirements, set forth in the ASME Code, Section XI, "Rules for Inservice Inspection of Nuclear Power Plant Components," to the extent practical within the limitations of design, geometry, and materials of construction of the components. The ISI Code of record for Oconee Nuclear Station, Unit 1, third 10-year interval is the 1989 Edition of the ASME Code. The components (including supports) may meet the requirements set forth in subsequent editions and addenda of the ASME Code incorporated by reference in 10 CFR 50.55a(b) subject to the limitations and modifications listed therein and subject to NRC approval. The codes of record for the repairs described within this request are the 1989 Section III and 1992 Section XI codes.

Description of Code Requirements for Which an Alternative is Requested

There are two sections of the referenced code for which an alternative is requested:

1. IWA-4500(e)(2) defines the band to be inspected following a temper-bead repair as the area of 1-1/2 times the component thickness or 5 inches, whichever is less.

2. Paragraph IWA-4533 specifies that "The weld repair as well as the preheated band shall be examined by the liquid penetrant method after the completed weld has been at ambient temperature for at least 48 hours. The repaired region shall be examined by the radiographic method and, if practical, by the ultrasonic method," following repair of dissimilar materials using the temper bead process in accordance with IWA-4530.

An alternative to the band area described in IWA-4500(e)(2) and an alternative to the radiographic examination requirements of IWA-4533 are requested.

Description of Proposed Alternative

In lieu of the requirements of IWA-4500(e)(2) and IWA-4533, the following alternatives are proposed:

1. Within the band around the weld repair, as defined by IWA-4500(e)(2), an interference exists that would prevent using the liquid penetrant examination method over 100% of the band area. It is proposed that the band area exclusive of the interference be examined by the liquid penetrant method. A diagram of the underside Reactor Vessel (RV) head band area surrounding a typical repair of a Unit 3 Control Rod Drive Mechanism (CRDM) is provided by Attachment 1.

2. Due to the thickness of the RV head and the complex geometry of the Unit 3 RV head in the area of the CRDM nozzles, examination of the repair regions by the radiographic method stipulated by IWA-4533 is not practical. It is proposed that examination by the ultrasonic method be substituted for the radiographic method.

Background Information and Justification for Using the Proposed Alternative

Background Information

Normal inspections of the Unit 3 RV head during a forced outage to repair a Pressurizer code safety valve discovered small amounts of boron emanating from the CRDM nozzle interface with the outside radius of the RV head. Boron deposits were discovered at this interface for CRDM nozzles Nos. 3, 7, 11, 23, 28, 34, 50, 56, and 63. This pressure boundary degradation was reported to the NRC on February 19, 2001 in accordance with 10CFR50.72(b)(3)(ii). Subsequent non-destructive examinations utilizing eddy current and ultrasonic methods have been completed for the base metal of the subject CRDM nozzles. Liquid penetrant examinations have also been

completed for each J groove partial penetration weld connecting the above CRDM nozzles to the inside radius of the RV head. These examinations revealed the existence of indications in the base metal of the nozzles and in the J groove partial penetration welds. The indications can be grouped into three categories: (1) indications in the J groove partial penetration weld, (2) indications in the nozzle base metal above the J groove partial penetration weld, and (3) indications in the nozzle base metal at and below the J groove partial penetration weld. No indications were found in the low alloy steel RV head material.

Justification for using Alternate Examination Area

Repairs to CRDM nozzles and welds involve removal and replacement of the defective material by the temper-bead process per the provisions of IWA-4530. IWA-4500(e)(2) defines a band around the weld repair of at least 1-1/2 times the component thickness or 5 inches, whichever is less, that shall be preheated and maintained at a minimum temperature. Due to the thickness of the RV head, the 5-inch minimum is utilized for definition of the band area.

IWA-4533 requires that the repair area, as well as 100% of the band area defined in IWA-4500(e)(2), be examined using the liquid penetrant method forty-eight hours after the repair is completed. The 4-inch outside diameter (OD) CRDM nozzles project through the band. It is proposed that the band area exclusive of the 4-inch OD CRDM nozzles receive examination using the liquid penetrant method following the weld repairs. A minimum of 90% of the band area defined in IWA-4500(e)(2) will be inspected by the liquid penetrant method. In addition, the inner diameter surfaces of the nozzles shall be inspected by the liquid penetrant method. These same areas will also receive examination following the weld repair using the ultrasonic method. The combination of these two methods will provide assurance that unacceptable flaws in the Reactor Vessel Head material around the CRDM nozzle weld repair areas can be detected.

Justification for using Ultrasonic Examination (UT) in Lieu of Radiography (RT)

The geometry in the vicinity of the CRDM nozzles is a poor orientation for an effective radiographic examination. The thickness of the RV head limits the sensitivity of the detection of defects in the J groove partial penetration weld thickness. It is proposed that examinations by the ultrasonic method be used in lieu of examinations by the radiographic method.

UT examinations will be performed in accordance with the requirements of the 1989 ASME Code, Section III, subsection NB. The acceptance standards of Paragraph NB-5330 will be applied for the UT examinations.

With the exception of the exclusion area described above, the weld deposit, buildup deposit, and base metal within a 5-inch band around the repair will be ultrasonically examined to ensure the absence of indications which can be characterized as planar or laminar defects, lack of fusion, or incomplete penetration. Any discovered indications or imperfections must be within the limits specified in NB-5330.

The UT examination procedures and techniques are based upon industry standards for the examination of large volumes of weld materials developed for the Boiling Water Reactor weld overlay examinations. The UT examinations consist of a combination of 0 degree longitudinal wave, creeping wave (ODCR) and 60 degree longitudinal wave search units. The 0 degree longitudinal wave is performed to detect any lack of bond areas between the weld materials and original parent materials, inter-bead lack of fusion, and any laminar type cracking within the base material of the examination volume. The ODCR search unit is used to detect welding defects within the weld deposit such as cracks or lack of fusion between weld beads. The 60 degree longitudinal unit will detect cracking in the parent base material beneath the weld deposit and welding defects within the weld deposit.

The ultrasonic examination procedures used for the CRDM nozzle repair examinations were developed based on the qualified techniques of the Performance Demonstration Initiative (PDI) weld overlay procedure. Essential variables of the PDI

qualified weld overlay examination procedure, such as search unit selection (size, angle, and frequency), scanning parameters (speed, index, and sensitivity), and application of each search unit are contained within the examination procedures used for the Unit 3 repair examinations. The PDI qualified procedure was modified for the specific geometry and configuration associated with the repairs of the CRDM nozzles. Additional changes were incorporated to include the ASME Section III, NB-5330 Acceptance Standards. Examination personnel are qualified in accordance with the ASME Section XI, Appendix VII and Section III, NB-5520 requirements. Examination personnel are also qualified to other industry programs such as Section XI, Appendix VIII and to the above-discussed procedure.

The initial calibration of the examination system provides a demonstration of the procedure, equipment, and examiner capabilities to detect and resolve the 3/32-inch diameter calibration reflectors located within and below the weld material deposited on the calibration block. This demonstrates the sound beams are adequately penetrating to the intended depth for the examination.

These ultrasonic methods provide assurance equal to that gained from the radiographic method in that unacceptable flaws in the Reactor Vessel Head material around the CRDM nozzles can be detected.

The Quality and Safety Provided by the Proposed Alternative

The purpose of the examinations required by IWA 4500(e)(2) and IWA 4533 is two-fold:

1. The original rules were written within the context of repairing a detected flaw in base metal. As such, there was a concern for other existing flaws in the immediate area. The first purpose of the examination is to detect flaws that may be revealed as a result of the repair. In this case, there are no flaws in the base metal that are being repaired. The purpose of the repair is to replace the defective nozzle, weld and, where applicable, base metal material with acceptable material. The proposed inspection method of all available surfaces within the heated band is sufficient to verify that defects have not

been induced on the edge of the weld repairs due to the repair process.

2. Performance of the temper bead repair could result in under bead hydrogen induced cracking. The second purpose of the examination is then to verify that no under bead cracking has occurred during the 48-hour hold period. The ultrasonic inspection method is perfectly suited for the examination of the weld to head interface, through the weld thickness, to detect the possible presence of under bead cracks.

Justification for Granting Relief

Duke believes that compliance with the post-repair examination areas to the requirements of IWA-4500(e)(2) presents a hardship due to the unique geometry of the CRDM nozzle to RV head interface. The proposed examination areas will provide adequate evidence that the low alloy steel RV head, the butter between the weld and the low alloy steel, as well as the replacement materials meet the requirements of the ASME codes.

In addition, Duke believes that compliance with the post-repair examination methods required by IWA-4533 present a hardship or unusual difficulty without a compensating increase in the level of quality and safety. In order to use RT, the CRDM nozzle-to-RV head would have to be redesigned which would result in extensive through-wall repair that would subject the vessel to internal stresses and subject personnel to large radiation doses. Moreover, the results of a RT would be questionable because of density changes between the base and weld metal and residual radiation from the base metal would render the film image inconclusive. Therefore, compliance with the Code RT requirement would create unusual difficulties and hardship. The proposed alternatives provide an equivalent level of quality and safety. These alternatives will effectively demonstrate the CRDM weld and nozzle flaw repairs will restore the required leakage and structural integrity, thereby maintaining the applicable code safety margins.

Due to the previous repairs to the Oconee Unit 1 thermocouple nozzles and CRDM nozzle 21, the Unit 3 CRDM repairs described herein, and Primary Water Stress Corrosion Cracking concerns throughout the nuclear industry, Duke is planning to replace

the Oconee Units 1, 2 and 3 RV heads. The plans are focusing on replacement of the RV heads between 2003 and 2006.

Duration of the Proposed Alternative

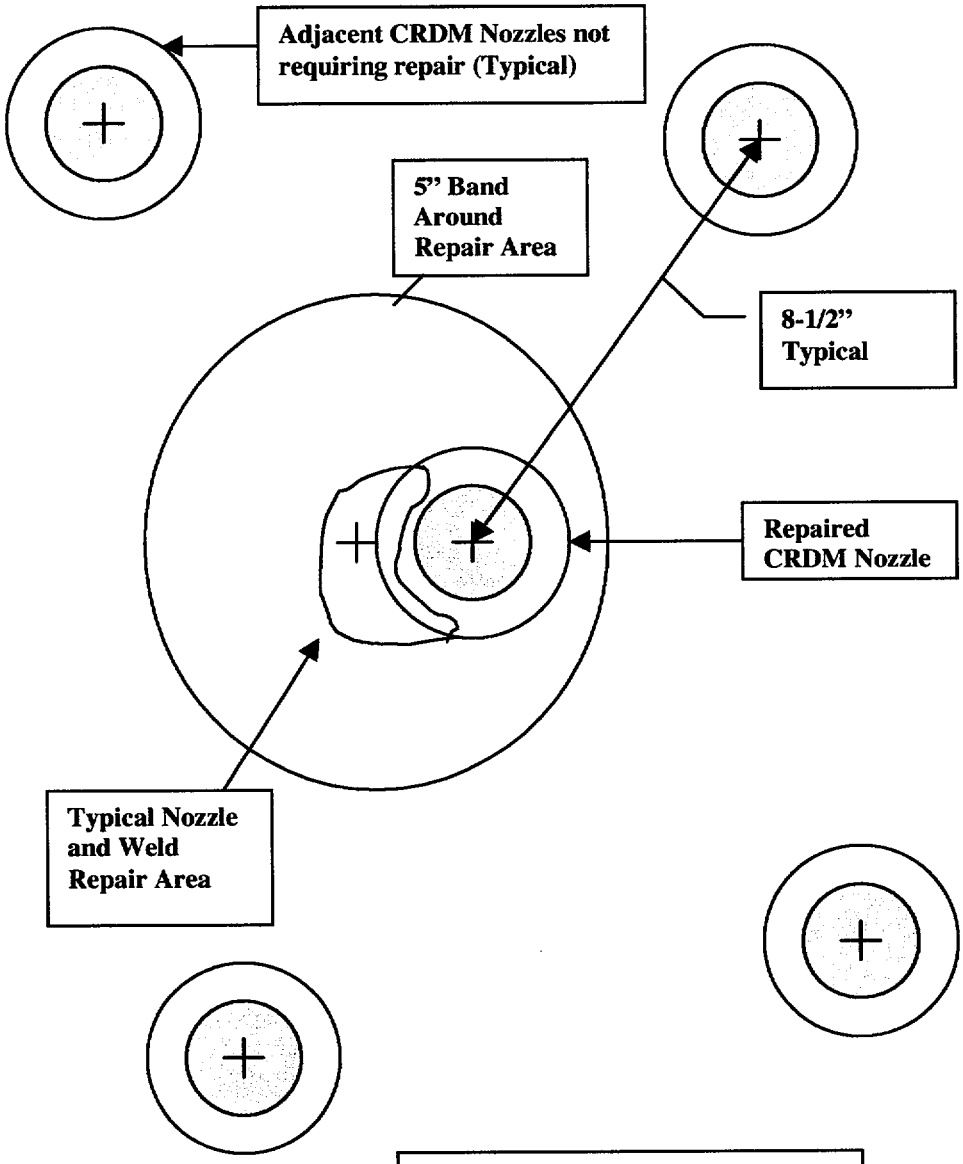
The proposed alternative is only applicable to the examinations to be made after the repair to the subject Oconee Unit 3 RV head CRDM nozzles.

Implementation Schedule

This Request for Alternate is associated with the ongoing repair of the Unit 3 RV head CRDM nozzles. Entry into Mode 2 operation is currently scheduled for April 16, 2001.

Originated By: Timothy D. Brown 3-29-01
Timothy D. Brown Date

Reviewed By: Leonard J. Azzarello 3/29/01
Leonard J. Azzarello Date



Attachment 1: Partial Plan of Oconee Unit 3 RV Head (Looking Up)